Smart Cities

Proceedings Report

The Smart City Initiatives in South Africa and Paving a Way to Support Cities to Address Frontier Issues Using New and Emerging Technologies as Part of the Innovation for Inclusive Development (IID) Seminar Series

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The Academy of Science of South Africa (ASSAf) was inaugurated in May 1996. It was formed in response to the need for an Academy of Science consonant with the dawn of democracy in South Africa: activist in its mission of using science and scholarship for the benefit of society, with a mandate encompassing all scholarly disciplines that use an open-minded and evidence-based approach to build knowledge. ASSAf thus, adopted in its name the term 'science' in the singular as reflecting a common way of enquiring rather than an aggregation of different disciplines. Its Members are elected based on a combination of two principal criteria, academic excellence and significant contributions to society.

The Parliament of South Africa passed the Academy of Science of South Africa Act *(No 67 of 2001)*, which came into force on 15 May 2002. This made ASSAf the only academy of science in South Africa officially recognised by government and representing the country in the international community of science academies and elsewhere.

This report reflects the proceedings of The Smart City Initiatives in South Africa and Paving a Way to Support Cities to Address Frontier Issues Using New and Emerging Technologies as part of the Innovation for Inclusive Development (IID) Seminar Series held at St George's Hotel, Pretoria. Views expressed are those of the individuals and not necessarily those of the Academy nor a consensus view of the Academy based on an in-depth evidence-based study.

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ACKNOWLEDGEMENTS

This proceedings report is a product of the Academy of Science of South Africa (ASSAf) in partnership with the Department of Science and Innovation (DSI) on the Innovation for Inclusive Development (IID) seminars. The IID learning interventions align with one of DSI's strategic objectives, namely, to use "knowledge, evidence and learning to inform and influence how science and technology may be used to achieve inclusive development". The purpose is to demonstrate how innovative technology solutions may be used to improve the capacity of the State to deliver and improve access to basic services, and thereby advance local economic development.

The IID seminar titled: **The Smart City Initiatives in South Africa and Paving a Way to Support Cities to Address Frontier Issues Using New and Emerging Technologies**, was hosted on 3 September 2019 at St George's Hotel, Doornkloof, Rietvleidam, Pretoria. The intent of the seminar was to solicit input from various stakeholders that will feed into a number of processes and ongoing consultations to define characteristics of a smart city in the South African context, and how the concept aligns with the 2019 White Paper on Science, Technology and Innovation. The discussions acknowledged that technology was but one element of a smart city. However, to establish a common vision for the South African smart cities and establish cities that are inclusive and liveable; more productive, efficient and competitive on a global scale; environmentally, socially, financially and economically sustainable; and resilient to the effects of climate change, other aspects, including but not limited to, need to be considered:

1. A clear definition of what smart cities are in the South African context.
2. South African smart cities should link to the global market but provide solutions to local problems rather than trying to compete with first world countries.
3. National framework for smart cities in South Africa, which clearly defines roles and responsibilities of the key stakeholders (government, private sector and civil society) need to be integrated. There must also be alignment with the SDGs and the NDP.
4. Policies need to be flexible and amendable in line with the 4IR.
5. Government needs to firstly address all the existing challenges faced by South African cities rather than emulating first world smart city models.
6. The building blocks of smart cities, including: STEM education, citizen rights, enablers (such as power, water and internet connectivity), ur-

ban versus rural, regulations, and shared goal and vision, need to be taken into consideration.

ASSAf greatly acknowledges the DSI, all the speakers and the participants from various sectors including the public and private sector, non-governmental organisation (NGOs), academia and the local governments.

The contributions of the ASSAf Liaison Programme, led by Mr Stanley Maphosa and the contact person for this project Dr Tebogo Mabotha's contributions throughout the project are hereby acknowledged and appreciated.

Prof Himla Soodyall
ASSAf Executive Officer

WELCOME AND INTRODUCTION

Ms Nonhlanhla Mkhize, Chief Director: Innovation for Inclusive Development, Department of Science and Innovation (DSI).

Ms Mkhize welcomed everyone and expressed gratitude to the participants for having responded to the DSI's invitation. The event would feed into a number of processes and ongoing consultations on smart cities in order to provide an opportunity for actors in the National System of Innovation (NSI) to reflect on the characteristics of a smart city in the South African context and how the concept aligned with the White Paper on Science, Technology and Innovation (STI). One of the founding principles of the White Paper was harnessing STI for inclusive development in the South African context.

The conversation on smart cities and the diffusion of technologies was mentioned by the Presidential Commission on the Fourth Industrial Revolution (4IR) and had to take into account the country's investment in research and development (R&D) and technology production, and consider an enabling environment for the deployment of local technologies.

Government was working on a national framework for smart cities and research, development and innovation would be part of that framework. The DSI and its partners are already investing in initiatives aligned to the concept of smart cities. This seminar will provide an opportunity for the DSI to gain insight into the work being done by stakeholders other than government. The DSI together with the Department of Communications and Digital Technologies will consider appropriate platforms to share information in order to optimise complementing activities and eliminate duplication. Inputs from this seminar could influence government's choice of priorities for the next five-year cycle.

The series of IID Seminars provides an opportunity for the DSI to engage with stakeholders based on existing initiatives or new areas of work and serves to feed into DSI programmes and assist the department to frame interventions and reflect on areas that require improvement.

Ms Mkhize invited participants to communicate issues not raised or addressed during this seminar by email to Dr Mabotha at Tebogo@assaf.org.za.

SESSION 1: SMART CITY CONCEPT: SOUTH AFRICAN PERSPECTIVE

SALGA Smart Cities Framework (Mr Mxolisi Mchunu, South African Local Government Association, SALGA).

SALGA is a membership-based body of all municipalities in the country. SALGA represents, promotes and protects the interests of local government in various forms and on many different platforms. The ultimate goal is to strengthen local government in terms of efficient service delivery.

Smart cities concept was a global phenomenon of relevance to first world countries as well as the Global South, yet it was important to understand what smart cities meant in the specific South African context. The question of whether a smart city should be predicated on technology and automation or on creating efficiencies and improving the way things were done required lengthy deliberation.

The SALGA Smart Cities Development Framework addresses the modernisation and transformation of municipal functions and operations and the enabling technological capabilities, as well as the cross-cutting issues such as climate change.

The Maturity Model outlining four levels of from sustainable governance, enhanced service delivery and municipal data intelligence to citizen enablement was used to assess the maturity of municipalities in order to implement appropriate and compatible smart technologies. Making cities smarter was not simply about the development of technology but involved socio-economic, legal, political and environmental dimensions and addressed municipal functions in the various sectors. The framework grouped these elements as follows:

- Smart Economy (Competitiveness)
- Smart People (Social and Human Capital)
- Smart Governance (Participation)
- Smart Mobility (Transport and Information, Communication and Technology (ICT))
- Smart Environment (Natural Resources)
- Smart living (Quality of life).

Introducing smart technologies would stimulate entrepreneurship and job creation within local municipalities and provide opportunities for municipalities to consider advanced solutions as a means to improve service

delivery to their citizens and enhance transportation systems and urban management. The benefits of introducing smart technologies would outweigh the costs of implementation in the long-term.

SALGA is open to learning from other stakeholders about the implementation of smart cities and to further engage with them about how best to define the smart cities concept in the context of South African cities.

SESSION 2: SMART CITY CONCEPT: GLOBAL PERSPECTIVE

International Smart City Initiatives (Mr Guilherme Johnston, Global Business Engagement, Connected Places Catapult, UK) (via Skype).

Connected Places Catapult, a non-profit organisation that implemented projects all over the world, was created by the UK government to support the commercialisation of products and services related to urban innovation. Its main objective was to help develop the products and services that could meet the changing needs of cities globally, closing the gap between concept and commercialisation, unlocking opportunity and reducing innovation risk. It supported cities in the UK to be bolder and more progressive in their quest to deliver innovative projects in implementing smart cities in areas such as urban innovation, intelligent transport systems, mobility, air quality, water and sanitation. One-third of its funding came from the UK government, one-third from research and collaborative projects and the remaining third from commercial projects. Other branches of the Catapult family in the UK included Energy Systems, Offshore Renewable Energy, High Value Manufacturing, Digital, Cell and Gene Therapy, Precision Medicine and Satellite Applications.

There was a huge supply of growing UK companies that lead the world in advanced urban services. Cities created a demand for these services. Catapult worked to address the disconnect between the supply and demand by creating a market so that advanced urban services would be able to grow and barriers to the market removed, thereby helping cities to become smarter and companies to deliver innovation and create jobs. Catapult worked in the various dimensions of advanced urban services, such as design, planning, architecture, engineering, construction, infrastructure, urban data, software modelling and analytics, environmental management, professional services, urban resilience, real estate, urban health, and knowledge and skills provision.

Academia provided the research base that helped cities with innovation and new technologies were being developed by Small, Medium and Micro Enterprises (SMMEs), new innovators, companies and start-ups. Tier 1 suppliers partnered for research and development and validated performance, while cities built intelligent and smart processes and were buying innovation. Catapult tried to set innovation challenges as well as to de-risk innovation so that cities would be able to be better prepared to implement appropriate smart technologies rather than adopting ready-made solutions marketed by large international ICT conglomerates.

Currently, the estimated value of the global market for advanced urban services stood at USD 1 trillion and was expected to rise to USD 3 trillion by 2025. Catapult aimed to grow demand in the global market for UK innovations and support British firms to access new international opportunities so that the UK would be able to enjoy a disproportionately large share of the global market. Most countries included advanced urban services and smart cities in their strategies and regarded these as ways to improve the way cities worked and to generate jobs and business for them.

Some of the barriers for smart cities to access markets included:
- The lack of buyer confidence in technology
- Fragmentation and silos in terms of services and assets
- Poor market coordination
- Rigid regulatory environments
- Lack of evidence for business cases
- Privacy and security concerns
- A disconnect between supply and demand.

Discussion: Questions/Comments

(Comment) University of Johannesburg (UJ):
In South Africa, connectivity is one of the biggest challenges and Big Data plays an important role in smart cities. Infrastructure is essential in order to mitigate the risks that come with wireless connectivity.

(Response) Mr Mxolisi Mchunu (SALGA):
Reliable and cheap connectivity and data is the ultimate enabler for a smart city. The legislation in this regard is outside the realm of local government. SALGA wants municipalities to introduce the issue of data connectivity (at a reduced cost) as the fifth utility to the consumers. Another project to reduce the cost of data is at an advanced stage. In terms of mitigating risks relating to open data, it is necessary for the relevant departments and entities to enforce the relevant legislation and to ensure

that cyber security is not compromised. The framework addresses the use of Big Data and how it should be managed to prevent any intrusion to the data municipalities have control over.

(Response) Mr Guilherme Johnston (Connected Places Catapult, UK):
Open data is very important and new policies will have to be developed to allow citizen engagement with the data. This will help the data use and help develop businesses. It will be necessary to ensure connectivity and accessibility in order to implement the smart cities concept. This would make a huge difference to people's quality of life.

(Question) Prof Sijekula Mbanga (Nelson Mandela University, NMU):
- Connectivity in rural areas is almost non-existent. What capital investment is needed to address connectivity in the rural areas and who should pay for this?
- With reference to the barriers to the markets for smart cities, there is limited access to material supplies for technology and infrastructure upgrades in rural areas. What are your thoughts about extending material supply through more serious investment in factories?

(Response) Mr Mxolisi Mchunu (SALGA):
SALGA has not been able to quantify the capital investment that is required to resolve the issue of connectivity in rural areas. With regards to infrastructure installed by mobile operators in rural areas, they look at profitability and population density. There are higher returns in investment in urban areas. Government will have to engage with the operators about the social responsibility to provide connectivity.

(Response) Mr Guilherme Johnston (Connected Places Catapult, UK):
Connectivity is also a problem elsewhere in the world. People need connectivity in order to benefit from technologies. We will take this matter up.

(Comment) Mr Davis Cook (Research Institute for Innovation and Sustainability, RIIS):
I am interested to know how Catapult built a relationship with the investor community to promote start-up technology and where it sees this going forward.

(Response) Mr Guilherme Johnston (Connected Places Catapult, UK):
We are engaged with the investor community and also with large corporations to deliver on innovation projects and remain open to further engagements. We have developed a partnership with Shell Ventures to do some work in India working with start-ups and innovators.

(Comment) Mr Walter Brown (South African Knowledge Access Network SAKAN):
The issues of connectivity and affordability of data are intertwined. The South Africa Connect Broadband Policy defines that 2.5% of income should be set aside for connectivity of the poor to all ICT services, but 55% of South Africans live below the poverty line and cannot afford this. Since 2012, I have been involved in trying to structure the rapid deployment policy but there is reluctance to implement it at local government level. Local government is in the way of providing connectivity and affordability to the people of South Africa. Most developing countries provide very cheap broadband connectivity to any area including rural areas.

(Response) Mr Mxolisi Mchunu (SALGA):
Good points have been made. I will raise these questions with my colleagues and provide the answers.

(Comment/Question) Mr Bernd Oellermann (Department of Trade and Industry, the dti):
- If local government has not been able to provide standard, basic services, how will it be able to provide the technology solutions needed for smart cities?
- SALGA's strategy seems to be overtly focused on what government does. More of an enabling role is needed. The private sector can fulfil this role.

(Response) Mr Mxolisi Mchunu (SALGA):
- This is fair point. The bigger metros are at an advanced stage in providing services beyond the basic services. Data accessibility is not a luxury and is becoming an essential service. Municipalities should strive towards the ambitious targets set by smart cities.
- The maturity model is helpful as it removes the burden off the municipalities and allows them to focus more on their core business.

(Question) Mr Bernd Oellermann (the dti):
What does de-risking innovation mean?

(Response) Mr Guilherme Johnston (Connected Places Catapult, UK):
Catapult de-risks innovation by helping to test and deploy new technologies produced by SMMEs and start-ups.

SESSION 3: DEFINING SMART CITIES IN THE SOUTH AFRICAN CONTEXT: LEARNING FROM OUR CITIES' EXPERIENCES

Panel Discussion

Facilitator: Ms Stacey-Leigh Joseph (South African Cities Network, SACN)

The South African Cities Network (SACN) was established in 2002 with the aim of helping cities to think more strategically about what would be required to drive spaces that were more inclusive, sustainable and productive, and how these spaces were governed to ultimately achieve the transformation agenda. SACN's work has thus far helped cities to develop the knowledge and create the spaces and platforms for learning, information sharing to have better outcomes that improved people's lives over time. SACN focussed on strengthening the voice of cities to enable and strengthen their role in driving the transformation agenda. The network has produced the *State of South African Cities Report* every five years, aligning with local government elections. Besides reconfiguring institutions and considering what resources were required, the 2016 report pointed out that urban local governance was not only about local government, but about the various sectors in society (the State as a whole, the private sector, civil society and academia) and that innovation and creativity were facilitated and driven within the nexus of integration among these different actors.

SACN would like to encourage its member cities present in this seminar to give input to these discussions to help understand the support requirements of the cities and their experience over the past number of years. The conversation on smart cities is not new. Many lessons have been learnt, and challenges and opportunities within cities have been identified.

Some of the principles to be kept in mind when thinking about a common vision about what a smart city is and what drives the cities of the future, is:

- Smart cities should be about improving the quality of people's lives in alignment with the country's transformation agenda.
- 'Smart' needs to be thought of as a way of doing things and of engaging.

- Technology should not serve to widen the gaps that existed
- It is important to consider the purpose of technology and the long-term impact that technology will have on the country, and to work towards a common vision, understanding the roles of the different actors and avoiding duplication.
- Interventions need to suit the specific context and challenges.
- There needs to be conversations about trust in general and among actors.
- Need to consider the capability of various institutions.
- Innovation and creativity also came from spaces where people had to make their own interventions to resolve key challenges in their lives.

It is necessary to have a framework of how to engage with potential solutions and identify step-by-step changes (for example, mapping exercise of what is taking place in these spaces) that will need to happen in order to make the smart cities concept successful.

Panellists

Mr Segofatso Thepa, Enterprise Project Management Office (City of Ekurhuleni)

The five pillars of the Ekurhuleni Growth and Development Strategy (GDS) 2055, which encompassed the smart principles, are: re-urbanise to achieve sustainable urban integration, re-industrialise to achieve job creating economic growth, regenerate to achieve environmental wellbeing, re-mobilise to achieve social empowerment and re-govern to achieve effective cooperative governance. These pillars underpin the future vision for the city, which is being implemented in three phases. The first phase, which began in 2012, focusses on the city becoming well-managed, resourced and financially sustainable as a 'delivering' city. In the second phase, the city aims to become a 'capable' city through inclusive industrial economy, with meaningful reduction in unemployment and poverty. The third phase envisaged the city be a clean, green and sustainable African manufacturing complex to classify itself as a 'sustainable' city.

The implementation of the first phase projects underpinned by the Ekurhuleni Ten-Point Economic Plan. Challenges being experienced relates to the lack of a unified vision and definition of a smart city, as well as issues that have to do with communication and working in silos. Much more integration between Gauteng cities and a coherent policy for the implementation of smart cities is necessary, and it is important to share information and take lessons from other cities' experiences.

Mr Lawrence Boya, Smart Cities Programme (City of Johannesburg)

Mr Boya raised the following points:

- He was unaware of SALGA's Smart City Development Maturity Framework and requested SALGA to ensure the City of Johannesburg is involved in the important issues raised in Mr Mchunu's presentation.
- The main challenge for the smart city concept in South Africa is that government has not provided a national framework. In the absence of a national framework, cities will be inclined to define for themselves what they understand as smart cities. The smart cities concept is not about technology, but an approach to address certain issues, which in an African context has to do with addressing issues of competitiveness, so that the continent is able to raise its voice in the global economy. Technology is important as it enables countries to become competitive.
- It is disappointing that local government is represented by the CEO of SALGA only, post President Ramaphosa's appointment of the Presidential Commission on the 4IR. It remains unclear whether local government has been consulted about matters concerning the work of the Commission. Major cities in South Africa ought to be consulted in this regard.
- The lack of a national framework also results in a lack of proper coordination at a national level. For example, the country's broadband strategy focusses on rural areas, yet the country needs to have the infrastructure in rural as well as urban areas before the price of data can be addressed. The municipalities need to deal with access to data in a manner that is coordinated through strategies, guidelines or legislation. A digital economy requires a vibrant broadband fibre business to be in place.
- Municipal Integrated Development Plans (IDPs) do not relate to the concept of smart cities at all. The framework for the IDPs was designed decades ago and needs to be replaced with a new mandate for local government that focusses on raising competitiveness. In terms of strategic planning, South Africa does no longer lead the way in Africa and has to learn from other African countries.
- The Smart city programme is low priority for the City of Johannesburg, but ought to be an all-encompassing priority, integrating all the strategic planning instruments to deliver the Johannesburg smart city.
- From a national perspective, the National Development Plan (NDP) ought to be revisited to incorporate the 4IR and become the main strategic agenda of South Africa.

Discussion: Questions/Comments

(Question) Mr Felix Dube (North-West University, NWU):
To what extent does the law assist in the delivery of a smart city and to what extent is the law an impediment to this? How can such impediments be resolved?

(Response) Mr Segofatso Thepa (City of Ekurhuleni):
Every development in the city (from a Town and Regional Planning perspective) requires consultation with the relevant Act. Certain aspects of the Act would have to be amended to accommodate smart cities.

(Comment) Prof James Maina (University of Pretoria, UP):
'Smart cities' means cities that make use of ICT to improve the performance of their infrastructure and services in order to improve their efficiency, the quality of life of their citizens and efficiency and bringing down costs and waste. Technology is a means to an end. The problem is that cities are being sold technology to provide solutions to problems that are not clearly identified. It will be easier for cities, provinces and the State to come up with a framework once a definition of smart cities is agreed upon.

(Response) Mr Segofatso Thepa (City of Ekurhuleni):
The City of Ekurhuleni plans to have a unified vision that is clearly define what a smart city is, and this is lacking currently. One of my deliverables is to ensure that the city has a smart city strategy as well as a governance policy stipulating how the strategy will be implemented. It is important for us to know what we are dealing with and what the legalities are. The city's vision already talks to the developmental aspect of smart cities. ICT should be a component of that.

(Response) Mr Lawrence Boya (City of Johannesburg):
There is no universal definition of smart cities. Definitions are contextual, depending on where the city is in the world. What is common in all the definitions is that ICT is an enabler. Vendors are driving technology solutions but are not considering the challenges that need to be addressed. The starting point of the City of Johannesburg's GDS defines the diagnosis in terms of the challenges faced by the city, the vision and the outcomes. The problem is that the smart city strategy is seen as an add-on onto the IDP, for instance, but it should give content to the city's vision of becoming a smart city by 2040 and the IDP needs to reflect this. We have put out a roadmap in terms of the journey towards becoming a smart city, where every department follows a common direction to reach a maturation point. The city has chosen eight focus areas, with the citizen at the centre because everything we do must impact our citizens. The city

aspires to become a 24/7 city, both as an economy and in terms of access to municipal services. Central to this is the smart city architecture that is currently being developed and will address digital transformation and data governance.

(Question) Mr Walter Brown (SAKAN):
Before defining smart cities, it is necessary to define 'Smart'. 'Smart' is about being intelligent and having the technical acumen, noting that some solutions require a mind shift rather than a technology solution. Do the panellists have any projects or ideas from a smart city perspective to deal with climate change?
(Response) Mr Lawrence Boya (City of Johannesburg):
The City of Johannesburg's GDS commits to addressing climate change related issues. The climate change action programme is integrated into one of the focus areas.

(Comment) University of Johannesburg (UJ):
South Africa is still experiencing problems with the Second Industrial Revolution and now plans to leap to the 4IR. Energy and technical solutions still need to be provided to address the needs of the marginalised populace. Leaping into the 4IR will require consideration of scalability of trends and infrastructure, and the transition from legacy to intelligent systems. Business models will also have to adapt to the changing dynamics.

(Response) Mr Segofatso Thepa (City of Ekurhuleni):
The City of Ekurhuleni's Ten-Point Economic Plan deals with the revitalisation of township economies and digital cities as defined in the IDP. The 4IR concept is accommodated. Fibre cable is being installed to ensure connectivity. The city is currently dealing with the issues of a safe city, which includes issues of data and policy reviewing and enhancement.

(Comment/Question) Dr Ntsibane Ntlatlapa (Council for Scientific and Industrial Research, CSIR):
- A national framework would help define 'smart cities' for South Africa. Such a framework needs to be developed as soon as possible.
- What coordination is there between national, provincial and local government in delivering services?
- The two cities presented different smart city frameworks which reflect both the current lack of a unified smart city vision and the fact that our cities are different and would thus require different approaches in developing and implementing smart city strategies. What is the key problem that the City of Ekurhuleni and the City of Johannesburg expect to be resolved by the smart cities concept?

(Response) Mr Segofatso Thepa (City of Ekurhuleni):
In terms of the key problems to be resolved by smart cities, the City of Ekurhuleni does have pockets of excellence where initiatives are currently being implemented. The main issue is to have a unified vision for a smart city and to start changing the culture and mindset. We are trying to create an environment where successful programmes can be implemented, using the data from strategic initiatives. Currently there is a disjuncture between the data coming from the strategy and what we are supposed to be delivering on.

(Comment) Ms Stacey-Leigh Joseph (SACN):
We therefore need to learn from other cities and their experiences particularly on the continent. It is necessary to develop a monitoring and evaluation (M&E) framework to be able to assess the long-term impact of implementing smart cities within the South African context.

SESSION 4: BREAK-AWAY SESSIONS

Framing a Support Programme for Smart Cities in the South African Context.

The following questions were put to the groups for discussion:
1) How is a smart city characterised in the South African context?
2) Are there any policies and/or institutional mechanisms in existence to support smart cities? Are they adequate?
3) What initiatives/programmes exist to support South African cities where frontier technologies are being used to improve urban outcomes?
4) Which role players are required to support smart city initiatives? What is/should their role be?
5) What role can the private sector and civil society play to support future cities using new and emerging technologies such as the 4IR, Big Data, the Internet of Things (IoT), ICT and Artificial Intelligence?
6) What educational skills are required to maintain smart cities' infrastructure? Are our educational institutions producing the required relevant skills?
7) What policy recommendations are necessary to ensure that smart cities are realised in a manner that benefits local communities?

Discussion Group 1 – Government, Non-Government Organisations (NGOs) and Non-Profit Organisations (NPOs)

Facilitator: Dr Mark Napier, CSIR Smart Places, CSIR
Rapporteur: Mr Kholani Mbhiza, Academy of Science of South Africa, ASSAf

Dr Napier suggested that the discussion should steer away from defining smart cities and that the role of technology and how it is integrated into smart cities was important, not as a single solution, but as one of the many things that needed to be done to achieve a socio-economic outcome. The wellbeing of people was at the centre of the smart cities concept and a balance between integrating technologies and doing things more efficiently, and what that would mean for the country as a whole, needs to be established. The big technology push had to be dealt with appropriately and the various sectors in society would have to understand how to integrate this to achieve the best possible outcome.

Dr Napier reduced the seven guiding questions to three discussion points and introduced each one.

1) **What does it mean to have smart cities in South Africa, what is appropriate and what do we want?**

Dr Mark Napier, CSIR:
Smart cities are inevitable. Numerous levels of technology are becoming available, but which ones should be adopted and assimilated to local conditions?

Mr Bernd Oellermann, the dti:
Smart cities in South Africa should link to a global market base and cannot only focus on this country's needs and needs to have a long-term view.

Ms Sheena Satikge, Department of Agriculture, Land Reform and Rural Development (DALRRD):
- Although smart cities in South Africa would have to link globally, they would firstly have to provide solutions to the day-to-day challenges. For example, the City of Johannesburg has 'safe' cities as one of its pillars, but there will have to be smart solutions to gender mainstreaming and smart apps that help prevent gender violence.
- It is important to consider the health risks of using technology to be smart. For example, what research has been done with regard to Wi-Fi radiation and the impact of technology in general on people's health?
- The draft National Spatial Development Framework (available on the DALRRD's website) has a 2050 vision and outline the work to be done

by various sectors. Participants are encouraged to give input to the document, especially the sections on ICT, in order to strengthen the final draft.

Mr Lebohang Masolane, Department of Planning, Monitoring and Evaluation (DPME):
The concept of smart cities implies mobility and connectivity (with infrastructure at the core) that can be used as a lever for development.

Ms Khetsiwe Mtiyane, Energy and Water Sector Education and Training Authority (EWSETA):
EWSETA was of the view that it is important to ensure that all citizens have the necessary skills to access online services and apps before being considering connectivity and the dissemination of technologies.

Ms Mapule Letshweni, SALGA:
There is a desperate need for an integrated national framework for smart cities that addresses all the issues raised to ensure that all sectors work towards a common purpose. Roles and responsibilities, the contribution of local government and resource requirements must be clarified. What other models are there apart from SALGA's maturity assessment model? What kind of research needs to be conducted? The most crucial need is for us to start working towards a framework for smart cities in South Africa. This will bring the much-needed coordination of efforts.

Dr Kishor Nair, CSIR:
I see smart cities as a subset of the global smart city cases, but in line with the challenges that are unique to this country. The increased migration from rural to urban areas necessitates implementation of smart solutions.

Ms Elizabeth Mokotong, Waterberg Business Forum:
We embrace innovation but most knowledge systems are imported and disregard adaptation to Indigenous Knowledge Systems (IKS). Technology can become dangerous in that it can become a tool to manipulate and manage people without helping them to manage themselves. Mass-based technology approaches are necessary but in order to be advantageous, they must integrate all eleven official languages and their related value systems, and be embraced and used by everyone.

Dr Mark Napier, CSIR:
Much of the technology push that is happening negates interaction with IKS and local practices. Power relationships and the selling of high-scale smart solutions to cities is very big business. The role of academics is important to critique the roll-out of smart cities and the vested interest that exists.

Comment:
A smart city should be defined as one that is future-proof and can be proactively prepared for any eventuality and can withstand the inevitable shocks from external circumstances (for example, those to do with climate change).

Mr Walter Brown, SAKAN:
Should the phrase 'smart city' be used? This is a fashion statement. We talk about technology and smart cities, but how do these help us overcome poverty, for example? If we manage to define a smart city and get all the technology that is needed to justify the definition, what is of utmost importance is to make the whole process people-centric. If we re-shape the conversation, we might be able to succeed.

2) Do we have the policies, the institutional mechanisms and the legislation to mediate smart cities? Where are the gaps at the moment?

Dr Mark Napier, CSIR:
One of the main challenging concerns is having to use government procurement regulations because the system is not geared towards setting up a website or design an app, which involves maintenance and support over many years. There are issues at a much higher level relating to the ethics of surveillance and regulatory requirements to mediate smart city technologies.

3) What are the role players and their roles?

Dr Mark Napier, CSIR:
Role players are government, the private sector and civil society. When talking about roles, it is necessary to consider the implications of running the system, access to information and how it will be used. How can the underlying foundation of civil rights and recourse to the courts be strengthened? The role of the private sector (not only domestic) is to sell technology. Whoever controls the data has a lot of power. If the State is relied on as a fifth utility to sell data, will it be done efficiently and, in a trust-worthy manner? Can the private sector be trusted with personal data?

Mr Mxolisi Mchunu, SALGA:
We always say that the role of the State is to create an enabling environment and yet, all too often, the State falls short of this. The State creates red tape and then creates a red tape reduction strategy. This is a big problem. Smart cities around the world have seen ingenious solutions come out of local inventions by people who are able to resolve problems in their day-today lives, but this is not possible to do if the State does not

create the right environment. The process to register intellectual property (IP) is so tedious and expensive that solutions produced by entrepreneurs get lost and forgotten. The State must do more to encourage entrepreneurship by facilitating IP process to create an enabling environment.

Mr Walter Brown, SAKAN:
What is the State and how do you relate to that State? One of the problems in developing the ICT infrastructure for South Africa is about who is responsible to develop the urban poverty-stricken areas and the rural areas? The debate has been that government does the initial investment and the private sector gets involved when it becomes financially viable. This is an unhealthy case of them versus us. If the country's leadership is drawn from the disastrous education system, it should make us think about who the State is and who the private sector is, and how to get the two to work together. Breaking the barrier between State, private sector and citizens is crucial for moving ahead.

The smart city discussion needs to be linked to the Sustainable Development Goals (SDGs) and the NDP. The target for ICT in the SDGs is 3G and then 4G coverage. These goals have not been achieved. Mobile penetration is all over the country, but the majority of people can only use their mobile phones for basic purposes. This must be dealt with.

Dr Paul Plantinga, Human Sciences Research Council (HSRC):
Our cities are fragmented socially. The advantage of cities is the proximity and learning that takes place between people. To define a smart city and its relationship to the State is to look at what we are trying to rebuild socially and understand how to support the growth of new social networks and rebuild those as spaces where innovation and creativity happen. From a government and State perspective, a more sophisticated understanding of how government interfaces to some of the emerging social networks and how to support these is needed.

Ms Sheena Satikge, DALRRD:
- Civil society can use technology as a means to mobilise, take action and provide solutions. This has been seen elsewhere in the world.
- The City of Tshwane provides access to Wi-Fi and I have wondered why other cities have not followed suit.

Comment, DSI:
For the DSI, the smart cities discussion is not only about technology. It is about ensuring that there are new operating models in municipalities, solutions are people-centric solutions and smarter business processes. Culture and context are key. At the centre is a systems approach to smart cities.

They cannot be realised by just one organisation. This requires a number of stakeholders to collaborate using integrated data models. Municipalities cannot work in silos. There is a role of SALGA and the SACN in this.

Ms Elizabeth Mokotong, Waterberg Business Forum:
Most IDPs are cycled year after year. Policies have to be flexible and amendable in line with the 4IR. It is necessary to cultivate a culture of equity between innovators and business through equitable partnerships, possibly brought together by research institutions.

Dr Kishor Nair, CSIR:
Smart cities must use appropriate and relevant technology and be in line with national programmes.

Mr Ngaka Machete, National Planning Commission (NPC):
South Africans tend to be easily attracted to any new technological trends without understanding the impact these might have. SALGA has visited Paris to experience how the city is implementing the smart city concept, but their concept does not fit into the South African context. There will be forces that want to gain from this by presenting themselves as experts in smart cities and selling false dreams to municipalities. It is important to start by resolving the basic challenges before moving to higher level issues. As a third world country, South Africa cannot use technological solutions applicable to first world countries and expect to compete with those countries. We do not have the resources but want to jump the gun by being part of the smart cities. This is not realistic now, but might be in thirty years' time.

Comment:
Smart buildings are able to reduce carbon emissions by bringing together water, energy etc. into the built environment. A smart building could be very high-tech or can use natural ventilation and walls designed for thermal mass. A better regulatory framework and culture of innovation that allows for new materials and designs would facilitate this concept. Informal settlements are one of the major issues in our cities and can be addressed through smart design and building from a town planning point of view. Enabling the reuse of inner-city buildings is another consideration, but regulatory issues currently prevent this from taking place.

Ms Susan Veldsman, ASSAf:
Where does urban resilience come in and what role does it play in contributing towards a smart city? This addresses the problems relating to safety, gender mainstreaming and collection data.

Dr Mark Napier, CSIR:
The CSIR has developed what is called '*A Green Book'* that models and measures the current exposure and vulnerability of every municipality from a water, energy, governance, management capacity, climate modelling (and so forth) perspective, and gives a specific set of challenges that every municipality in the country faces and the action to be taken in order to be in the right place in twenty years' time. All municipalities should make reference to this work. In addition, there is work on an evidence-based response to crime. The technology must be matched with the ability and willingness to respond.

Comment:
The way that we have gone about spatial development has not been intentional in terms of doing away with Apartheid spatial development. Some of the social ills emanate from the lack of social cohesion and integration. Government has not responded to this. Like education, this is one of the fundamental challenges of this country that makes it different to other places.

Comment:
As a social enterprise, my company provides social housing in townships. However, government systems tend to be a barrier to innovation that could improve people's lives. The innovation pipeline needs more support to make it easier for smaller enterprises to operate.

Comment:
In terms of smart cities, it should be noted that the success of a few over the failure of many will be targeted as a failure.

Mr Bernd Oellermann, the dti:
There are many different perspectives and lots of information available on smart cities. My concern is how this will be coordinated. Nothing can be done unless there is a vision that everybody buys in to. There needs to be sufficient alignment and buy-in across the country or nothing will happen. But we also need to understand what people need and want. We need people who are passionate about smart cities and have the energy and resources to follow through. Working groups can be established in all the different areas. A lot more targeted engagement is necessary.

Mr Segofatso Thepa, City of Ekurhuleni:
The Sector Education and Training Authorities (SETAs) need to be involved in enhancing skills within the municipalities so that they are able to serve their communities better.

Discussion Group 2 – Private Sector and Academia

Facilitator: Prof Walter Musakwa, University of Johannesburg, UJ
Rapporteur: Ms Thato Morokong, Academy of Science of South Africa, ASSAf

The facilitator introduced the session by summarising how speakers during the earlier sessions had defined smart cities and some of the issues that had to be faced in realising the concept:

- The speaker from the City of Johannesburg was thought-provoking. He raised the issue that South Africa did not have a national framework for smart cities; there was a lack of collaboration among the parties involved in promoting the concept of smart cities; and municipal Integrated Development Plans (IDPs) did not relate to the concept of smart cities at all.
- The South African Cities Network defined smart cities as cities that improve quality of life, services and liveability.
- The speaker from Connected Places Catapult in the UK spoke of innovation, support, challenges of funding and barriers for smart cities to access markets. Some of these barriers overlapped with those identified by the City of Johannesburg.
- SALGA associated smart cities with ICT, modernisation, smart technology and big data.
- A common thread in defining smart cities is related to data, ICT and improving people's lives.

1) How is a smart city characterised in the South African context?

Prof Walter Musakwa, UJ:
The first issue to be addressed is how to define smart cities, especially in the South African context. There are four theories related to defining smart cities, in relation to:

1. Information and smart machines, involving ICT, big data, 4IR and the IoT.
2. Partnerships and collaboration between the private sector, academia and various spheres of government. Previous sessions identified some missing links in terms of partnerships and collaboration.
3. Learning from others, re-learning and adapting, including feedback through M&E frameworks and assessment programmes. The possibility of learning from Rwanda, Kenya and Tanzania (Dar es Salam) had been mentioned. An example of being smart is picking up litter and discarding it in separate bins for food waste, glass and plastic. This does not necessarily require money or technology, but requires a suitable mindset.
4. Investing and planning for the future.

Mr Thato Sekgoele, UJ:
Communication would be important from the South African context in order to inform people about, for example, the location of the closest services, outlets and facilities, as well as networks in terms of route mapping. Communication should be available to connect people with information from government and private organisations. Other important aspects of smart cities are accessibility, scalability, liability, security, and notification of unlimited services for enhancing services, for example surveillance and proactive responses with respect to security and safety. Surveillance presents an opportunity to offer information about the products and services that citizens need by monitoring and evaluating demand and supply, in order to enhance their availability for citizens. Artificial intelligence is not the panacea for all ills, but mitigating factors are required to enable the human aspects of smart cities.
Technology should be integrated into smart cities (e.g. into the emerging Waterfall City). Smart cities should be connected with a range of products and services, addressing challenges of service delivery among other things. An important aspect of smart cities is to be proactive with respect to sustainability and maintainability.

Mr Ephraim Phalafala, DSI:
In defining smart cities, four majority levels need to be taken into consideration, as proposed by SALGA. The definition of a smart city in relation to Johannesburg, for example, would be different from a semi-rural municipality in the Eastern Cape. We also need to take into account that cities exist in different landscapes, with different levels of economic development. For example, level 1 municipality would look at improving governance, level 2 municipality would entail enhancing service delivery, level 3 would look at municipal data intelligence and level 4 could most probably look at citizen engagement in the provision of services. The common denominator of smart cities is to take advantage of ICTs.

2) Are there any policies and/or institutional mechanisms in existence to support smart cities? Are they adequate?

Prof Walter Musakwa, UJ:
Are smart cities what people want, or are factors such as housing, water and jobs more important?

Dr Thobela Nkukwana, UP:
Urban agriculture should feature in smart cities. A current feature of South African cities such as Johannesburg and Pretoria is the lack of demarcation of what happens where. Smart cities would need to have clearly demarcated places for different activities (e.g. banks, informal vendors, taxi

ranks) and clear directions to guide visitors from abroad to find their way and the things they are looking for.

People in smart cities should be able to drive their own cars, but in Johannesburg and Pretoria for example, motorists struggle to find parking. Taxis and buses should stop only at designated places where commuters can get on and off safely. There should also be designated routes for pedestrians. A smart city should plant trees and enhance the green environment of the city.

Ms Tankiso Phidza, Gemini GIS and Environmental Services:
Environmental management is an important aspect of smart cities. The South African Bill of Rights (Chapter 2 of the Constitution) must be taken into account so that smart cities become citizen-centric. One of the rights in terms of the Bill of Rights is that the environment should not be harmful to people's health or wellbeing, it must secure "ecologically sustainable development and use of natural resources while promoting justifiable economic and social development". Sustainability is recognised as relating to environmental, social and economic issues, and thus to all the basic needs of people.

3) What initiatives/programmes exist to support SA cities where frontier technologies are being used to improve urban outcomes?

Prof Walter Musakwa, UJ:
It is open to debate whether smart cities are a misplaced priority.

Question:
- People have been engaging with the concept of smart cities for more than a decade, so what is stopping smart cities from being realised today?
- Why would a South African city in its settlement planning continue to expand the Apartheid spatial planning system in relation to shelter, water and sanitation management?
- Why do decisions taken at various levels – political, administrative and financial – continue to perpetuate the challenges of the past in the post-Apartheid city?
- We are trying to fix cities of the past that were created for different purposes and retrofitting existing townships. In the process we are missing the opportunity to consider a different model of a city and create new cities from scratch, as other countries have done. What would be the elements of a smart city if we could recreate Johannesburg on an expropriated land?

Prof Walter Musakwa, UJ:
The new Waterfall City, for example, is supposed to be smart and sustainable. The development is driven by private developers. Does Waterfall City meet the criteria for a smart city, or does it simply repackage the way in which cities of the past have been developed?

Comment:
The stakeholders within the locality where the smart city is implemented need to be identified. Among citizens as stakeholders, it is important to identify the mix, including the most and least vocal and the oppressed. Other stakeholders of the city include central government with its interests, targets, goals and what it seeks to gain from the city; local government which is concerned with security, revenue collection and the adequacy of services; the private sector, which requires services in order to register and conduct business in different parts of the city, including locations, suburban areas and industrial complexes; as well as environmentalists and those concerned with the rights of animals. In order to address congestion and pollution, the city of Barcelona (Spain) for example created zones without vehicles that could only be accessed on foot or by bicycle, with the intention of increasing the number of zones in the city without vehicles. For Barcelona, this initiative represents the implementation of the smart city concept. South Africa could determine what is understood as a smart city in a particular context by addressing the needs of the various stakeholders.

Prof Walter Musakwa, UJ:
From the various contributions, the concept of a smart city in the South African context would be inclusive on various scales, including race, income and infrastructure. Is Waterfall City inclusive with regards to these terms?

Mr Thato Sekgoele, UJ:
In South Africa, the approach to smart cities must take indigenous knowledge, local materials and resources into account, while borrowing from the West and the East to develop integrated solutions. New and inclusive frameworks and policies will have to be considered, in order to design for environmental sustainability, maintainability, maximum output (e.g. with respect to the use of natural light as far as possible rather than electricity) and the use of renewable resources. Cultural intelligence needs to be integrated into the framework as it plays a big role in terms of attitudes towards smart cities. The model for smart cities involves the five Ds, namely disruptive mechanisms, delinking, decommodification, deglobalisation and digitisation. South Africa needs to learn from the best available information in moving forward.

Prof Walter Musakwa, UJ:
In South Africa, the national institutional policies, resources and mechanisms for enabling smart cities include SA Connect, the Universal Service and Access Agency of South Africa (USAASA), the Electronic Communications and Transactions Act (No. 25 of 2002), the Science, Technology and Innovation Roadmap for Sustainable Human Settlements (STI 4 SHS), and the Human Settlements Framework on Innovation. There are fragmented policies.

4) Which role players are required to support smart city initiatives? What is/should their role be?

Mr Davis Cook, RIIS:
In South Africa, there are very few tech start-ups in the smart city space, and they are not represented at this seminar. Those who are implementing change are not participating in the debates, partly because they are driven more by connecting people in ways that make money than by the policy environment. Creating an environment that makes it easier for start-ups and entrepreneurs to test ideas in as low-risk a manner as possible and it enables the emergence of new technologies often in unforeseen ways. The private sector is often not involved in conversations about new approaches. Part of the collaboration process should entail creating a triple helix that involves the start-up and corporate community, government and academia, and citizens themselves. That consortium has not been well understood or properly established in South Africa.

Comment:
The private sector is often more in touch with ordinary people than local government. Strategically helping municipalities to save money could contribute to job creation (e.g. by reducing wasteful expenditure on non-revenue water).

Mr Davis Cook, RIIS:
Many companies across Africa view their role as replacing services that the public sector is not providing adequately. Although these companies are profit oriented, in many cases they have a strong social mission at the core of what they do. Whether they are providing financial literacy or access to clean water, for example, they recognise that they are able to run a good business while also doing good. This is essential to many of the more successful start-ups.

Comment:
Various types of infrastructure contribute significantly to the economy, society and quality of life, including energy, water, sanitation, wastewa-

ter, solid waste, telecommunication, transport, buildings and recreational facilities. If we want to be systematic, we should unpack each kind of infrastructure and identify the needs as well as the gaps over various time frames. This would open opportunities for the private sector. At present, the private sector is taking the initiative to identify gaps and opportunities and influence people's thinking, resulting in a lack of a systematic or co-ordinated approach.

Prof Walter Musakwa, UJ:
Why is this not happening, as the private sector has capacity, know-how, skills and money?

Comment:
Installation costs are enormous. This is a big problem especially for rural areas. Government needs to make it easier and cheaper to access infrastructure, data and connectivity.

Comment:
There is a risk of monopoly. When the private sector installs internet connectivity in suburbs, for example, this process is often closed to competition, which increases the costs. Public–private partnerships are important. Government should provide the basics and then open up opportunities to the private sector.

Mr Strauss Heigers, Smartlock:
There are many obstacles to partnerships between the private and public sectors due to bureaucracy. ICT is not the only service that is affected, but also water and sanitation. Clean water is likely to become one of the scarcest resources in South Africa, and monitoring and controlling water use will become increasingly important in future. The smart city concept must be applied to monitor and properly control all the important infrastructures for a city.

Prof Walter Musakwa, UJ:
Perhaps this is not happening at the scale required to move forward.

5) What role can the private sector and civil society play to support future cities using new and emerging technologies such as the 4IR, big data, IoT, ICT and artificial intelligence?

Prof Walter Musakwa, UJ:
The Vodacom network is 5G ready, and Vodacom considers that all South Africa's major cities are capable of big data, IoT, ICT and artificial intelligence. From a technical perspective, the platform is in place. The onus is

on cities to engage in partnerships with technical enablers such as Vodacom in order to take advantage of the opportunities. The private sector enables smart city initiatives especially in the metropolitan areas of South Africa. Hence there is lack of partnerships between private sector and government.

6) What educational skills are required to maintain smart cities infrastructure? Are our educational institutions producing the required relevant skills?

Prof Walter Musakwa, UJ:
Educational institutions are not producing people that can work with big data, IoT and artificial intelligence. People have to be sent to the USA or China to be retrained in order to manipulate technologies. Schools not producing graduates that are tech savvy.

South African educational institutions tend to train people in order to be employed, with a focus on theory. People are not trained to start their own businesses or to become entrepreneurs. The top universities in the world focus more on the practical aspects that are important for start-ups. We are failing the students, although the mindsets of students are also a challenge because they have been told by their families and society that they should seek employment and get a job. Municipalities have adopted the notion of smart cities but lack capability for implementation. Much needs to be done from an education perspective to train people.

Mr Thato Sekgoele, UJ:
The gaps between scientists, engineers and politicians needs to be bridged in order to take a coordinated approach. This may require some unlearning and to acquire a new set of skills required in the new age in order to be progressive. Disciplines and skills may need to be integrated in multidisciplinary or transdisciplinary manner in order to bridge the gap. Different approaches are required, as it will not be possible to address the challenges through a uniform approach or by parties functioning in isolation. The private sector, academia, politicians and the policy environment need to work together in an integrated model to facilitate the interchange of knowledge and development of skills.

Comment:
The role of universities is to train students fundamentals and expose them to what is happening. If people are not trained they will not have sufficient foundation to rely on as technology changes.

Comment:
Higher education is not a homogeneous sector. In South Africa, technical and vocational education and training (TVET) colleges are supposed to produce innovators. Europe is trying to drive a dual system of education. Workplaces in general are struggling with techno skills. This needs to be addressed from an investment perspective.

Prof Walter Musakwa, UJ:
South African higher education institutions tend to emphasise research with research papers as the output, and technical aspects receive less attention.

Mr Rongedzayi Fambasayi, North-West University (NWU):
Children have been a missing piece in the discussion around smart cities. In the discussion, it is assumed that the educational institutions that are referred to are universities and other training institutions, but the discussion should start at primary school level in order to ensure that children are educated to prepare them for smart cities. UNICEF has projected that by 2030, 60% of people living in cities will be children. The definition of smart cities, as well as planning for smart cities, should take the rights and interests of children into account. This is especially important in our context, since children's rights are explicitly mentioned in the Bill of Rights.

Prof Walter Musakwa, UJ:
Children are future customers, and we need to know their requirements.

7) What policy recommendations are necessary to ensure that smart cities are realised in a manner that benefit local communities?

Comment:
Policies related to smart cities need to be linked with current IDPs for the development of communities. This would ensure that developments in cities respond to issues of green buildings. Basic services that are included in IDPs sometimes create problems for other services; for example, delivering sanitation may place a burden on water supply. As cities are developed, linkages need to be made so that, for example, the sanitation systems that are installed use less or no water.

Prof Walter Musakwa, UJ:
IDPs need to be relevant to smart cities. There is a disjuncture between IDPs, legislation, spatial development frameworks and the concept of smart cities. Partnerships must be central to any policy recommendations in relation to smart cities. The issue of trust needs to be addressed, as raised by the South African Cities Network.

Comment:
Partnerships are crucial, as a chain is only as strong as the weakest link. We need to work together for coherence between all facets of the smart city concept.

Mr Barry Nkomo, Motor Industry Bargaining Council (MIBCO):
The training and development environment suffers from this disjuncture. SETAs need to establish partnerships to coordinate the initiatives of higher education and training sector including universities, universities of technology and TVET colleges. The DSI had previously raised the possibility of using technology to provide services, which could help to bridge the gap between IDPs, service delivery by municipalities and innovation.

REPORT BACK FROM BREAK-AWAY SESSIONS

Discussion Group 1 (Dr Mark Napier, CSIR and Mr Kholani Mbhiza, ASSAf)

1. Smart cities should link to the global market while providing solutions to local problems, and not try to compete with first world countries.
2. Applying the gender lens and gender mainstreaming should be embedded in planning for smart cities.
3. Smart apps could be used to combat gender-based violence.
4. Mobility and connectivity will require a focus on infrastructure.
5. Access to information is a serious problem. Issues relating to the ethics of surveillance through smart city technologies would have to be addressed.
6. The digital divide needs to be recognised and dealt with.
7. There is a need for integrated national framework for smart cities in South Africa, which clearly defines roles and responsibilities of the key stakeholders (government, private sector and civil society). There must be alignment with the SDGs and the NDP.
8. If the State controls the data, it has the power, but who is the State?
9. The role of the State is to create an enabling environment where people can contribute. Red tape is a barrier to innovation and entrepreneurship.
10. There is a tendency to import knowledge systems in terms of technologies and disregard adaptation to IKS.
11. A clear definition is needed of what smart cities are in the South African context, allowing for local interpretation.
12. Smart cities must take a people-first approach, be society-centric and address local challenges.

13. Is government or the private sector responsible for the development of rural areas?
14. Smart cities cannot be realised by just one organisation, it requires a systems approach through collaboration and the use of integrated data models. SALGA and SACN have roles to play in this regard.
15. Policies need to be flexible and amendable in line with the 4IR.
16. Government needs to start by addressing all the existing challenges faced by South African cities and not emulate first world smart city models.
17. The building blocks of smart cities are: STEM education, citizen rights, enablers (such as power, water and internet connectivity), the discussion about urban versus rural, the need for regulation (updated and new), stronger institutions (drawing on the SETAs), and a shared goal and vision (allowing local authorities autonomy to define their societies and economies).

Discussion Group 2 (Prof Walter Musakwa, UJ and Ms Thato Morokong, ASSAf)

1. To be successful in establishing smart cities requires collaboration, partnerships, coherence, as well as consistency.
2. In terms of defining smart cities, it is necessary to provide connectivity (whether through transportation, the internet or social interaction) as well as information and service delivery to citizens. Smart cities have to be sustainable (environmentally, socially and economically) and provide intra- and intergenerational equity. The key elements are stakeholders (these need to be identified), identifying local problems and devising local solution to those problems.
3. The notion of a smart city is contextual, even at a local level. Are we benchmarking or imitating? We need to understand what a smart city is within the context of South Africa, and it is important to invest in the future based on people's needs.
4. A comprehensive approach should not limit service delivery to the metropolitan areas, but incorporate peripheries.
5. The various maturity levels are helpful in indicating municipalities' readiness to implement smart cities. The process will start with addressing the basics and move towards implementing more and smarter technology and systems.
6. Will smart cities address the problems resulting from Apartheid Spatial Planning?
7. Much of the regulation is outdated and needs to be revised.
8. Harmonisation of policies and a change of mind set from working in silos is crucial.
9. The IDP framework does not align with the smart cities concept.

10. There are many obstacles in implementing smart cities.
11. Start-ups are the drivers of ICT and need to be involved in this debate and partner with the large conglomerates.
12. From an education perspective, the gap between skills and technology is evident. There is a need to maintain the dual system of education that balances theory with application and is updated in line with the requirements of the IoT and the 4IR, but also allow for more flexible curricula that address the technical aspects of developing smart cities.
13. Various national frameworks support the smart cities concept, but the missing link is the municipalities.
14. Infrastructure is key to promoting smart cities.

CLOSING REMARKS

(Ms Nonhlanhla Mkhize, Chief Director: Innovation for Inclusive Development, DSI)

Ms Mkhize thanked participants for their contributions to the discussions and invited them to provide further input to Dr Mabotha (Tebogo@assaf.org.za) by Monday 9 September 2019. The DSI, as one of the departments involved in the smart city space, would share the report from the seminar with its colleagues.

A national framework on smart cities would need to meet basic needs in a manner that advances inclusive economic growth in an environmentally sustainable manner. It was acknowledged that technology was, but one element of a smart city and it was important to determine whether systems were in place to enable local economic growth.

Information about seminars on smart cities hosted by other departments would be shared with participants, and the DSI would welcome proposals on how to engage further on this topic.

ANNEXURE A: LIST OF PARTICIPANTS

Title	Name	Surname	Organisation
Ms	Nadia	Algera	Academy of Science of South Africa (ASSAf)
Mr	JP	Alkema	Smartlock
Mr	John	Bodiroa	Department of Social Development (DSD)
Mr	Crucial	Bondamakara	North-West University/Cities, Law and Environmental Sustainability (NWU/CLES)
Ms	Maricelle	Botes	NWU/CLES
Mr	Lawrence	Boya	City of Johannesburg
Ms	Sanmari	Briedenhann	Department of Planning, Monitoring and Evaluation (DPME)
Mr	Walter	Brown	South African Knowledge Access Network (SAKAN)
Dr	Michelle	Burger	University of Pretoria (UP)
Mr	Udit	Chauhan	ZAMI Technologies (Pty) Ltd
Mr	Shadreck	Chuma	Future Africa Consulting and Training
Ms	Samkelisiwe	Chunda	Sibayeni Metrofarming
Mr	Davis	Cook	Research Institute for Innovation and Sustainability (RIIS)
Mr	Leslie	Daniso	BroadXcess
Dr	Pravesh	Debba	Council for Scientific and Industrial Research (CSIR)
Ms	Songo	Didiza	Green Building Design Group
Mr	Felix	Dube	NWU/CLES
Mr	Rongedzayi	Fambasayi	North-West University (NWU)
Ms	Cebakazi	Gebeda	CITEPLAN
Dr	Jeremy	Gibberd	CSIR/UP/GAUGE
Ms	Jokudu	Guya	South African Cities Network (SACN)
Mr	Strauss	Heigers	Smartlock
Dr	Jonathan	Hess	Embassy of France in South Africa
Ms	Stacey-Leigh	Joseph	SACN
Mr	Mhlonipheni	Khakhuse	South African Bureau of Standards (SABS)
Ms	Andiswa	Khoza	Sibayeni Metrofarming
Mr	Theuns	Knoetze	CSIR

Title	Name	Surname	Organisation
Mr	Kagiso	Kobue	Brain Trust
Ms	Mapule	Letshweni	South African Local Government Association (SALGA)
Ms	Nahungu	Lionjanga	RIIS
Ms	Precious	Lukhele	Department of Science and Innovation (DSI)
Dr	Tebogo	Mabotha	ASSAf
Mr	Ngaka	Machete	National Planning Commission (NPC)
Ms	Nompumelelo	Mahlangu	ASSAf
Prof	James	Maina	UP
Ms	Andronicah	Makhubela	NWU/CLES
Mr	Aaron	Malomane	DPME
Mr	Monde	Maluleka	DPME
Mr	Floyd	Masemola	ASSAf
Mr	Israel	Mashigwana	Department of Water and Sanitation (DWS)
Ms	Neo	Mashilo	ASSAf
Ms	Doris	Mashiloane	Capricorn District Municipality
Mr	Lebohang	Masolane	DPME
Mr	Mathibe	Masuku	Bakgatla Ba Kgafela Development and Welfare (BBKDW)
Prof	Sijekula	Mbanga	Nelson Mandela University (NMU)
Mr	Kholani	Mbhiza	ASSAf
Mr	Mxolisi	Mchunu	SALGA
Ms	Philippa	McLaren	International Finance Corporation (IFC)
Ms	Nonhlanhla	Mkhize	DSI
Ms	Itumeleng	Moagi	DPME
Ms	Mahlaku	Mojapelo	Capricorn District Municipality
Ms	Elizabeth	Mokotong	Waterberg Business Forum
Mr	Katlego	Mokwena	City of Ekurhuleni
Ms	Thato	Morokong	ASSAf
Ms	Jeanette	Morwane	Department of Telecommunications and Postal Services (DTPS)
Mr	Tshepang	Mosiea	DSI
Ms	Khetsiwe	Mtiyane	Energy and Water Sector Education and Training Authority (EWSETA)
Ms	Khodani	Mulaudzi	World Wildlife Fund (WWF)

Title	Name	Surname	Organisation
Prof	Walter	Musakwa	University of Johannesburg (UJ)
Mr	Gareth	Muthumuni	DPME
Ms	Rosemary	Mwanza	University of Eastern Finland
Mr	Elogran	Naicker	Kwemvelo Group
Dr	Kishor	Nair	CSIR
Dr	Mark	Napier	CSIR Smart Places
Mr	Nhlanhla	Ndlovu	Hustlenomics Pty Ltd
Mr	Mulisa	Nemakonde	DPME
Mr	Tiyani	Ngoveni	DSI
Mr	Sabelo	Ngwane	Office of the Executive Mayor: Mogale City
Mr	Barry	Nkomo	Motor Industry Bargaining Council (MIBCO)
Dr	Thobela	Nkukwana	UP
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Dr	Ntsibane	Ntlatlapa	CSIR
Mr	Bernd	Oellermann	Department of Trade and Industry (the dti)
Mr	Zadok	Olinga	ÖLINGA
Ms	Istell	Orton	CITEPLAN
Ms	Maria	Paschini	MCP Architect & Arbitrator
Mr	Ephraim	Phalafala	DSI
Ms	Tankiso	Phidza	Gemini GIS and Environmental Services (GGES)
Dr	Paul	Plantinga	Human Sciences Research Council (HSRC)
Dr	Chantal	Ramcharan-Kotze	Water Research Commission (WRC)
Ms	Selaelo	Ramohlale	Department of Co-Operative Governance and Traditional Affairs (COGTA)
Mr	Geoff	Rees	Openserve
Ms	Petra	Rees	Why Toyz
Ms	Siona	Rikoo	EWSETA
Mr	Ashaal	Roopchan	Technology Innovation Agency (TIA)
Mr	Barry	Rossouw	Telkom
Ms	Sheena	Satikge	Department of Agriculture, Land Reform and Rural Development (DALRRD)
Ms	Chanel	Schoeman	CSIR

Title	Name	Surname	Organisation
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Ms	Samantha	Senosha	DPME/NPC
Mr	Vusi	Siwani	Lerothodi Community Development
Mr	Vincent	Siwawa	University of the Witwatersrand (Wits)
Mr	Stefan	Szewczuk	Independent Researcher
Mr	Segofatso	Thepa	City of Ekurhuleni
Mr	Michael	Toner	Coral-I Solutions
Ms	Coralie	Van Reenen	CSIR
Ms	Susan	Veldsman	ASSAf
Mr	Jonathan	Wilson	SACN
Ms	Lindelwa	Ximiya	City of Ekurhuleni
Ms	Diana	Zhou	DPME

ANNEXURE B: LIST OF ACRONYMS

3G	Third generation cellular network technology
4IR	Fourth Industrial Revolution
4G	Fourth generation cellular network technology
5G	Fifth generation cellular network technology
ASSAf	Academy of Science of South Africa
CEO	Chief Executive Officer
DALRRD	Department of Agriculture, Land Reform and Rural Development
DPME	Department of Planning, Monitoring and Evaluation
DSI	Department of Science and Innovation
EWSETA	Energy and Water Sector Education and Training Authority
GDS	Growth and Development Strategy
HSRC	Human Sciences Research Council
ICT	Information, Communication and Technology
IDP	Integrated Development Plan
IID	Innovation for Inclusive Development
IKS	Indigenous Knowledge Systems
IoT	Internet of Things
M&E	Monitoring and evaluation
NDP	National Development Plan
NMU	Nelson Mandela University
NPC	National Planning Commission
RIIS	Research Institute for Innovation and Sustainability
SACN	South African Cities Network
SAKAN	South African Knowledge Access Network
SALGA	South African Local Government Association
SDG	Sustainable Development Goals
SETA	Sector Education and Training Authority
STEM	Science, technology, engineering and mathematics
the dti	Department of Trade and Industry
TVET	Technical and vocational education and training
UK	United Kingdom
UNICEF	United Nations Children's Fund
USA	United States of America
USAASA	Universal service and access agency of South Africa

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Academy of Science of South Africa (ASSAf) & Department of Science and Innovation (DSI)